

Ag economist looks at crop challenges in cellulosic ethanol

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MANDAN, N.D. - With a new cellulosic ethanol plant being proposed near Spiritwood, N.D., Dave Archer, ARS agricultural economist, took a look at crop production challenges in the region and how the removal of crop residue for biomass could affect carbon sequestration.

Archer, along with a representative of the proposed Spiritwood cellulosic ethanol plant, spoke to producers at the recent ARS Northern Great Plains Research Laboratory and Area 4 Soil Conservation District Cooperative Research Farm forum.



There have been some dramatic shifts in crop production over the last 20 years or so in the area around the ethanol plant in Stutsman and Barnes counties, according to Archer. Wheat, he said, has dropped in acreage from 800,000 acres to around 250,000 acres while soybean acreage has increased from virtually none to about 700,000 acres, and corn has increased from a slight amount to about 300,000 acres in the area.

"Barley and sunflowers have virtually disappeared in the two-county area, while there has been a shift from wheat to corn and soybeans," he said.

Archer said the shift in acres has been driven by markets and the increase in corn yields from better varieties that have added four bushels per year for the last 20 years in Barnes County and three bushels per year in Stutsman County. There has been an increase in production for both soybeans and wheat of about one-half bushel per year over that time.

"Markets, as well as crop yields, will drive what producers grow in the future," he said.

While there is a lot of variability in the crops grown every year, Archer suspects growers will continue to keep spring wheat and corn in the rotations as both can spread out the harvest window, and both can be grown well in the region.

While the ethanol plant hopes to use mostly wheat straw for biomass, it has also decided to include corn stover as a secondary biomass commodity. However, there is twice as many soybeans grown in the two counties as either spring wheat or corn, and soybean residue was not considered as a biomass under the Spiritwood feasibility study.

To make selling the biomass profitable for the producer, the price has to include costs for harvest, nutrient replacement, transportation and storage costs, he said.

Using corn, a nutrient removal study at eight sites, including Mandan, showed that cobs removed about 10.9 pounds nitrogen/ton of cobs, while above the ear stover removed 14.9 pounds nitrogen/ton of stover and below the ear stover removed 12.8 pounds nitrogen/ton of stover.

There was also potassium and phosphorus removed as well and Archer said wheat straw would take out about the same amount of nitrogen (12.2 pounds nitrogen/ton of straw).

"There has been a lot of discussion whether you need to replace all of it with fertilizer," he said, adding that at some point, nutrients have to be replaced and that has to figure in with the price for biomass.

In addition, the soil resource has to be protected as an important function to protect against soil erosion and maintain soil carbon. Residue also is important for nutrient cycling, to reduce soil crusting, improve water filtration and reduce evaporation.

Archer used a simulation model to look at carbon sequestration from what it is now to what it might be in 25 years if some of the crop residues were removed to be used in the ethanol plant.

The results vary by soil type. For a Barnes County soil in a continuous wheat situation using chisel plow tillage, there is a downward trend in the amount of carbon stored under the soil surface.

But in a crop mix using a corn, soybean, spring wheat, soybean rotation and chisel plow tillage, the soil carbon would be slightly increased, while a corn/soybean only rotation using a chisel plow decreases soil carbon, he added.

Archer said if producers adopted a no-till planting method, it would stabilize the soil carbon. However, that may not work in the area with the cool, wet springs that usually occur in that part of the state.

Producers might be more willing to adopt strip-till methods for row crops which tend to warm and dry the soil.

"In terms of building soil carbon, strip till is pretty close to no-till," Archer said.

With regards to economics, Archer said field research near Morris, Minn., showed no significant yield difference among tillage systems, but no-till seemed to bring higher net returns than a moldboard plow tillage system.

In corn, NDSU research has shown generally no significant yield difference among tillage systems, however, there was a yield benefit using strip till compared to no-till at Fargo in 2007.

NDSU also indicated potentially higher input costs associated with strip till, he added.

"Right now, there is no large incentive for people to make that change (from conventional till to other tillage systems)," Archer said.

But another alternative for the biomass could be switchgrass. Planting switchgrass actually increases carbon in the soil from 80 tons per acre to 88 tons per acre over 25 years, according to the model simulation.

Yet with crop prices high, producers are not likely to make the switch from crops to switchgrass.

Another alternative for farmers could be adding cover crops in the rotation, he said. It could allow for residue to be harvested while providing cover that returns organic matter to the soil.

The question is whether producers will have time to get cover crops planted after harvest, and whether the benefits will be worth the additional costs.

"Surviving long term economically depends on maintaining farm productivity and profitability and the key there is maintaining soil productivity," Archer said.